PORTABLE COMMUNICATION DISPLAY DEVICE

RELATED APPLICATIONS

This application is a Continuation application of U.S. Ser. No. 08/857,273 filed May 16, 1997 now U.S. Pat. No. 7,310,072 which is a File Wrapper Continuation of U.S. Ser. No. 08/717,536 filed Sep. 23, 1996, now abandoned which is a File Wrapper Continuation of U.S. Ser. No. 08/327,113 filed Oct. 21, 1994, now abandoned which is a continuation in part of U.S. Ser. No. 08/287,970 filed Aug. 9, 1994 now abandoned which is a Continuation-in-Part of U.S. Ser. No. 08/220,042, filed on Mar. 30, 1994 now abandoned which is a Continuation-in-Part of U.S. Ser. No. 08/141,133, filed on Oct. 22, 1993; now abandoned the teachings of which are being incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

Head mounted display systems have been developed for a number of different applications including use by aircraft pilots and for simulation such as virtual imaging. Head mounted displays are generally limited by their resolution and by their size and weight.

Existing displays have relatively low resolution, and because of the size and weight of available systems, these displays are often positioned at the relatively large distance from the eye. Of particular importance, is the desirability of keeping the center of gravity of the display from extending upward and forward from the center of gravity of the head and neck of the wearer, where it will place a large torque on the wearer's neck and may bump into other instruments during use.

There is a continuing need to present images to the wearer of a helmet mounted display in high-resolution format similar to that of a computer monitor. The display needs to be as non-intrusive as possible, leading to the need for lightweight and compact system. Existing head mounted displays have used analog cathode ray tube ("CRT") devices mounted above or to the side of the user's head which project an image onto a surface or visor mounted in front of the user's eyes. Often these displays utilize helmets which incorporate earphones into the helmet. Other head mounted display devices have contemplated the use of liquid crystal devices that could be mounted above or to the side of the user's head and employ reflective optics to direct an image within the field of view of the user.

SUMMARY OF THE INVENTION

The present invention relates generally to systems and methods for mounting display and electronic systems on the human body for numerous applications including commercial, industrial and entertainment purposes. Due to the development of small, light weight, high resolution matrix displays, the use of these systems for head mounted and body mounted applications is expected to increase. The use of transferred thin film techniques and/or thin film single crystal silicon material to produce small, high resolution active matrix electronic displays is highly suited for the manufacture of head or body mounted displays is described in U.S. Pat. No. 5,206,749 (issued Apr. 27, 1993), U.S. Pat. No. 5,228,325 (issued Nov. 2, 1993), and U.S. Pat. No. 5,300,788 (issued Apr. 5, 1994), the entire contents of these patents being incorporated herein by reference.

Depending on the particular application, it is desirable to use either monocular or binocular systems for head mounted displays. For monocular systems, preferred embodiments have a single display and associated optics in a housing that can be positioned at the center of the filed of view of either of the user's eyes and can be moved partially or completely out of the user's field of view. Both monocular and binocular systems can be used with any video source. A preferred embodiment of the monocular system can be mounted to a frame with a hinge so that it can rotate in a vertical plane to a position above the field of view of the user. The frame can be secured to a support that holds the display on the head of the user. The frame can also house the wiring harness for the display as well as other communications systems described hereinafter.

A particular embodiment, uses either of the monocular or binocular systems with a head or body mounted computer system and a user interface. The computer and associated electronic components used to load programs, load and store data and communicate or network with other systems by wire or wireless operation can be mounted on the head-piece, or in other embodiments, on the chest, back, arms or around the waist of the user. The user interface can be a standard (ISO) keyboard, a collapsible keyboard in standard or non-standard format, a voice activated system a pen, a joystick, a trackball, a touch pad, or a virtual keyboard using motion sensitive gloves, or other suitable means depending upon the particular embodiment and application.

In accordance with a preferred embodiment of a binocular head mounted display, the system can include a housing in which a pair of matrix display elements are secured. These display elements are of a sufficiently light-weight and compact nature that the housing can be mounted onto the head of a user with a pair of hinge mounted arms or support elements that can be rotated relative to the housing from a closed position to an open position. When in the open position the arms extend about the opposite side of the user's head and serve to position audio transducers mounted on the arms into proximity with the ears of the user. The arms can also be double hinged in which each arm is folded once about its mid-point and then rotated about the hinge on each side of the housing to assume the closed position.

System electronics and manually adjustable controls can be positioned within the housing or the rotating arms, or on bands extending above or behind the head of the user. Positioning of the electronics and controls within the arms or bands permits a more desirable distribution of weight evenly about the sides or top of the user's head.

The inter-pupillary distance between the two displays can be adjusted such as by the use of a gear driven cam assembly mounted within the housing. Centering of both monocular and binocular displays within the field of view of one or both eyes can thus be accomplished manually, or alternatively by motorized gears or cams. Motors can also be incorporated into the support structure to move the display into, and out of, the user's field of view.

The direct view display can be a transmission type display with the light source directly adjacent the light valve active matrix and mounted within the display device. The transmission type display can, in a preferred embodiment, also receive light directly from the user's environment so that the display overlays an image over the users existing field of view.

Alternatively, the display can be an emission type device such as an active matrix electroluminescent display or an active matrix of light emitting diodes (LEDs), or transmissive passive matrix display or a reflective display.